

iCRASH'24

Improving work zone safety with digitization and C-ITS

Igor Mikolášek



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IGOR MIKOLÁŠEK
TRANSPORT RESEARCH CENTRE CDV

Improving work zone safety with digitization and C-ITS

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- Introduction and C-ZONE project overview
- Temporary traffic management model
- Dynamic temporary traffic management updating
- „Smart cone” concept
- Other (C-)ITS tools for improving work zone safety

Improving work zone safety with digitization and C-ITS

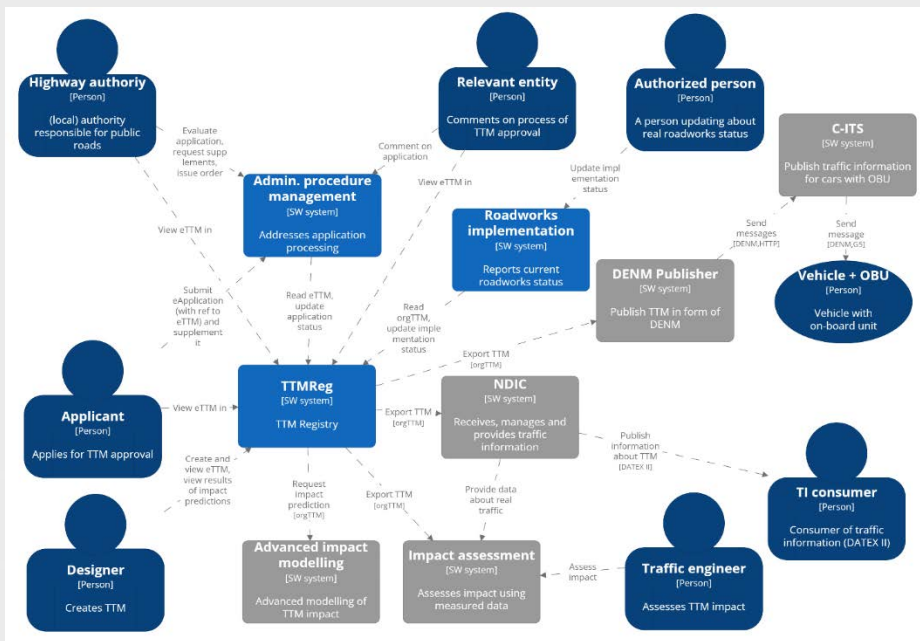
Project C-ZONE

- New central digital registry of temporary traffic management (TTM)
- Motivation
 - Providing machine readable TTM data for:
 - Autonomous vehicles
 - C-ITS
 - Navigation
 - Impact prediction
 - Work zone coordination
 - Digitization and process optimization
 - Multiple practical and process issues with current obsolete system
- Partial inspiration from US WZDxm, UK NOMS or Dutch SPIN information systems

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Project C-ZONE

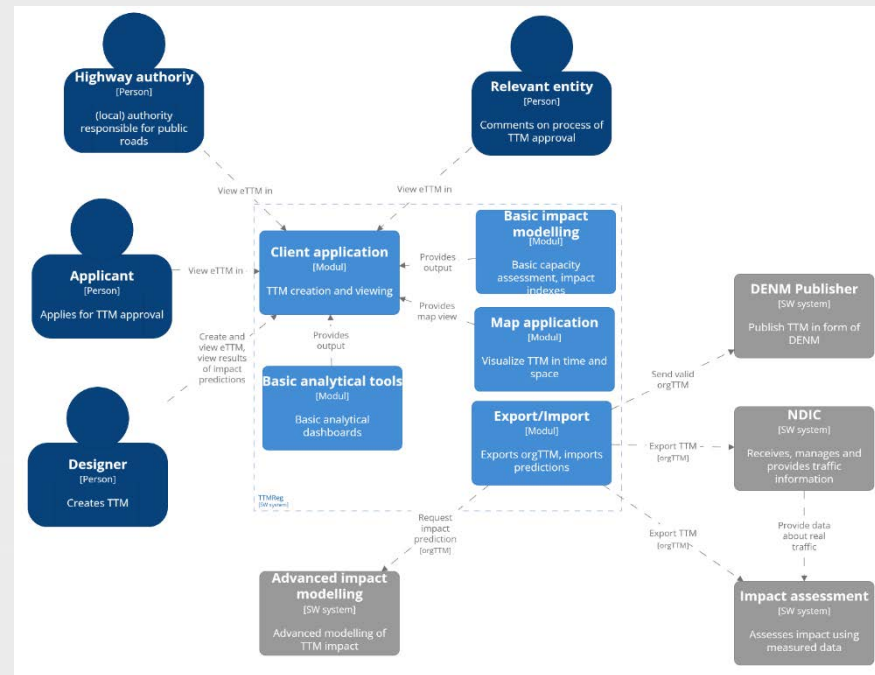
- Fully digital application and approval process
- New machine-readable description of road geometry and characteristics orgTTM
- eTTM = orgTTM + supplementary files
- Impact modelling
- Public data sharing via multiple channels
 - orgTTM -> DATEX II, C-ITS (DENM)
 - Web app view



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TTM registry

- Client application – create work zone
- Map application – visualize work zones
- Impact modelling tools – provide automatic impact evaluation and further guidance and warnings
- Analytic tools – performance evaluation, statistics
- Export/import APIs



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orgTTM

- Created in client web application incl. map/orthophoto for visualisation
- Using GlobalNetwork or similar network data for network geometry and routing
- Define stages with dates etc.
- Split carriageways into segments with constant parameters
- Define lane parameters
- Saved in orgTTM

The screenshot displays the orgTTM web application interface. The main view shows a map with a highlighted road segment. A sidebar on the right contains configuration options for the segment, including name, location, direction, and number of lanes. Below the map, there are three detailed configuration panels:

Segment 3 - 1. pruh

Omezení

Pruh uzavřen

Vedeno protisměrem

Maximální povolená rychlost [km/h]

60 km/h

Maximální šířka vozidla [m]

2.5 m

Maximální výška vozidla [m]

Neuvedeno

Maximální délka vozidla [m]

Neuvedeno

Maximální hmotnost vozidla [tuny]

7 t

Zákaz pro vozidla

Neuvedeno

Jízdní charakteristiky segmentu

Uložit Zrušit

Směrové poměry *

Směrové poměry v dopravním omezení jsou dobré, nem...

Nastoupané výškové metry

0 m

Frézování povrchu *

Pojízdná část vozovky není po celou dobu trvání etapy ...

Kvalita vozovky *

Bez významných nerovností, prahů, výtlačků s výjimkou fr...

Atraktivita pracovního místa *

Běžné, nezajímavé, či zakryté pracovní místo (defaultní vo...

Využití systému mobilního linového řízení

Zřízení střídacího provozu?

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orgTTM

- Lane-level data for navigation, impact modelling, and automatic alarms
- Incl. simplified temporary roads
- eTTM used for TTM approval process
- Published along with application at the latest -> easier coordinaiton

01	Nezúžený JP v původním uspořádání	07	Nezúžený JP v původním uspořádání – střídavý provoz
02	Zúžený JP v původním uspořádání	08	Zúžený JP vedený protisměrem – střídavý provoz
03	Uzavřený JP	09	Zúžený JP v původním uspořádání – střídavý provoz
04	Nezúžený JP vedený protisměrem	10	Nezúžený JP – přejezd SDP
05	Zúžený JP vedený protisměrem	11	Zúžený JP – přejezd SDP
06	Nezúžený JP vedený protisměrem – střídavý provoz		

orgDIO Omezení na 379 v0.1

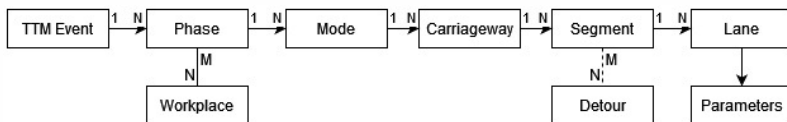
Kolize Dopady

Obnovit

Kolize pro uzavírku Omezení na 379
Generováno 26. 1. 2023 22:17:42 - 26. 1. 2023 22:17:43

Varování pro omezení etapy **Etapa 1**:

1. ▲ V místě plánovaného dopravního omezení je pro zadaný čas již schválená objížděná trasa jiného omezení. Kolize (uzavírka: Omezení na 379, etapa: Etapa 1, jízdní pás: JP 1) s (uzavírka: Uzavírka Vohančice (Tišnov), etapa: Etapa 1, objížděná trasa: Objížděná trasa pro všechna vozidla)
2. ▲ V místě plánovaného dopravního omezení je pro zadaný čas již schválená objížděná trasa jiného omezení. Kolize (uzavírka: Omezení na 379, etapa: Etapa 1, jízdní pás: JP2) s (uzavírka: Uzavírka Vohančice (Tišnov), etapa: Etapa 1, objížděná trasa: Objížděná trasa pro všechna vozidla)



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Impact on road safety

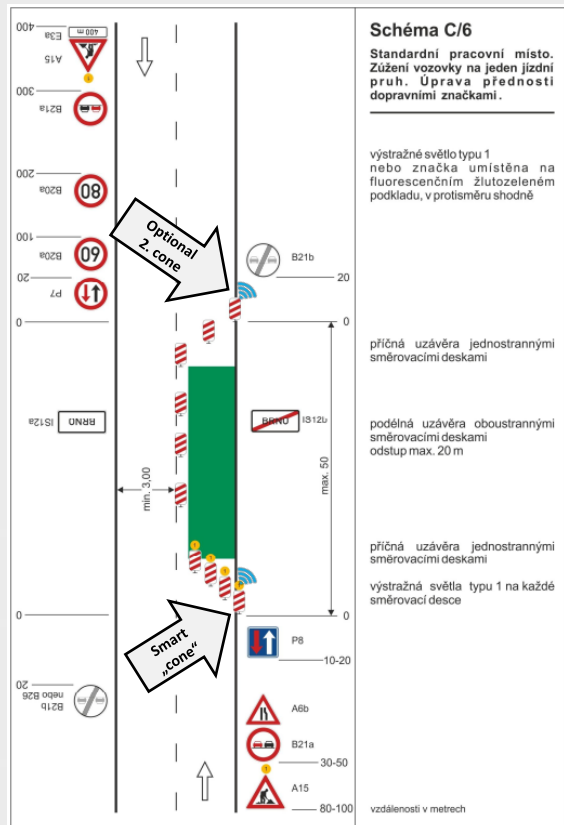
- Better coordination -> reduced delays -> reduced stress, aggression, accident risk
- Large machine-readable database -> research -> improved design rules
- Advance warning for drivers (navigation, C-ITS)
- Enhanced reliability of autonomous vehicles around TTM
- Impact prediction -> reduced delay, improved travel time reliability -> reduced stress

- **But... plans ≠ reality?!**

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Dynamic TTM updating

- Motivation
 - Schedule changes
 - Construction etapes
 - Extended TTM realisation windows
- Mobile app and/or smart cone real-time status updating
- orgDIO includes „modes”
 - Regularly changing or unique TTM alternatives within one etape
 - Time-table or manual switching in an app
- End users recieve current information about TTM



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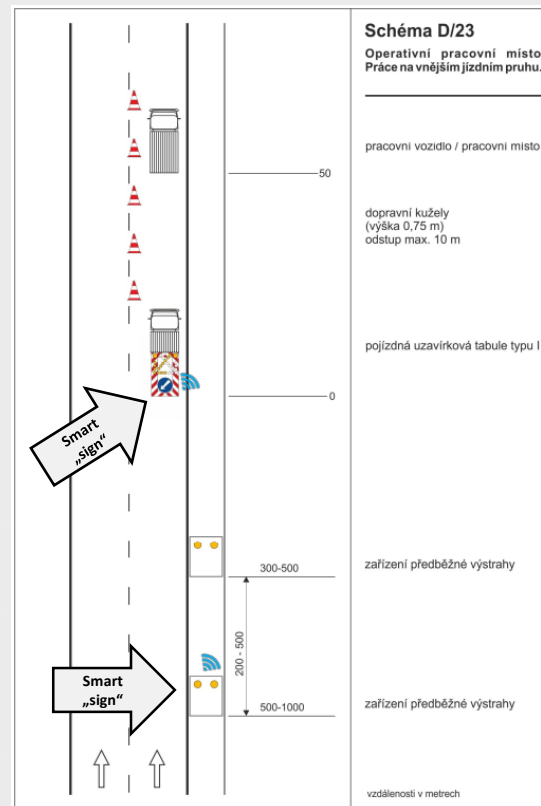
Smart „cone”

- First/last cone or pole to be used in work zone (in each direction)
- C-ITS, GSM, and GNSS equipped
- Optional Wi-Fi/BT for local connection
- Updates TTM status into TTMreg
- Beacons its real-time position
- Controlled via mobile app
- Provides I2V advance warning to incoming vehicles using „traces” and DENM

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Smart „cone”

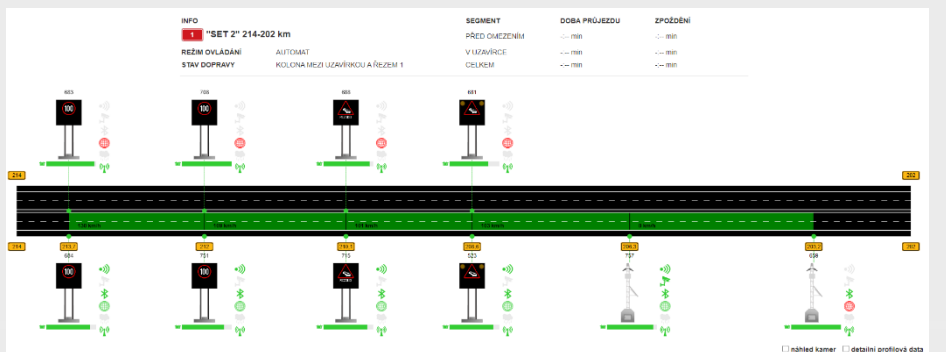
- C-ITS beacons in mobile traffic signs or maintenance vehicles
- Particularly useful for mobile work zones
- End of work zone optional
- Especially trucks tend to crash into maintenance vehicles and mobile signs
- Safety of workers



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Other potencial (C-)ITS equipment for work zones

- Portable variable traffic signs with VSL and congestion warning
- Speed harmonisation and reduction
- Advance warning
- Several measurement and variable traffic sign profiles



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Other potencial (C-)ITS equipment for work zones

- Movement detection sensors in mobile guard rails on freeways
 - Immediate warning to service workers
 - Potential connectivity to mobile VSL/VMS
- Standing vehicle detection within work zone
- C-ITS-based clearance detection in shuttle work zones
- Detection of active workers within work zone (app, smart vest, etc.) and C-ITS warning to vehicles

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Other potencial (C-)ITS equipment for work zones

- Freeway flow metering using controlled moving bottlenecks (Čičič et al. 2020)
- In-vehicle speeding alerts via I2V ahead or in work zone
- Other „common” tools
 - Portable average section speed control
 - Enforcement + travel time information
 - Vehicle gap measurement (and enforcement)

Inowrocław, 26 - 27.09. 2024 r.

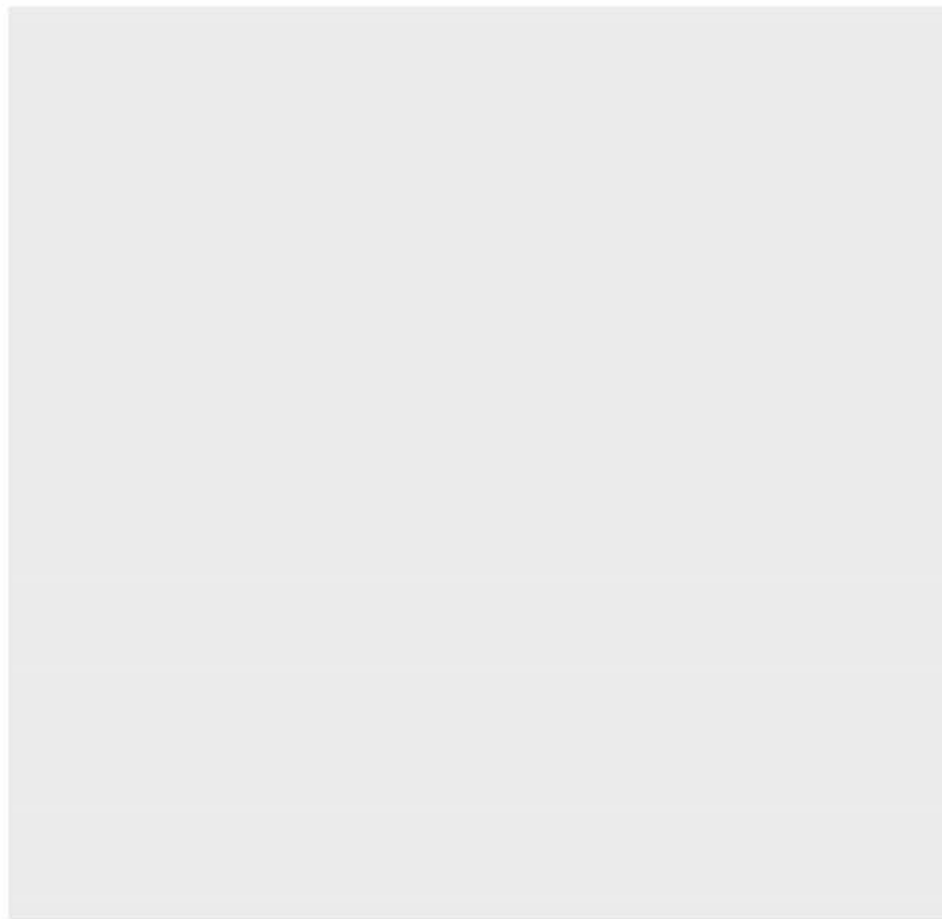
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DZIĘKUJĘ ZA UWAGĘ / THANK YOU FOR YOUR ATTENTION

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